CLAIMS

What is claimed is:

1. A method for oxidizing a fuel, comprising:

providing a catalyst mixture including at least one compound having at least one element selected from the group consisting of group III and group IIA, and at least one compound having at least one element selected from the group consisting of group IA, group IVA, group VI, group VII, group VIII, group IB, group IIB and combinations thereof;

mixing a portion of the catalyst mixture with combustion air prior to mixing the catalyst mixture with a fuel to be oxidized; and

oxidizing the fuel.

2. The method of claim 1, further comprising adding a liquid to the catalyst mixture before mixing it with the combustion air.

3. The method of claim 2, wherein the liquid comprises one or more liquids from the group consisting of ethylene glycol and water.

4. The method of claim 3, wherein the liquid further comprises lithium chloride.

5. The method of claim 1, further comprising sparging a gas through the catalyst mixture to generate fluidized catalyst particles to mix with the combustion air.

6. The method of claim 5, further comprising ionizing the sparging gas prior to sparging it through the catalyst mixture.

7. The method of claim 5, wherein the sparging gas is selected from the group consisting of air, helium, nitrogen, argon, and combinations thereof.

8. The method of claim 1, wherein the compound having a group III element is selected from the group consisting of $AlCl_3$ and $Al(NO_3)_3$.

9. The method of claim 1, wherein the catalyst mixture comprises one or more of platinum, rhodium, rhenium, manganese, iron, aluminum, magnesium and molybdenum.

10. The method of claim 1, wherein oxidizing the fuel comprises oxidizing the fuel in an open flame.

11. The method of claim 1, wherein oxidizing the fuel comprises oxidizing the fuel in an enclosed flame.

12. The method of claim 1, wherein oxidizing the fuel comprises oxidizing gasoline.

13. The method of claim 1, wherein oxidizing the fuel comprises oxidizing diesel fuel.

14. The method of claim 1, wherein oxidizing the fuel comprises oxidizing a fuel selected from the group consisting of number 2 fuel oil, fuel oil refined from crude oil, diesel fuel, gasoline, compressed or liquified natural gas, gasohol, any hydrocarbon having one or more carbon atoms such as methane, ethane, propane, butane, isobutane, toluene, xylene, octane, benzene, mixtures of alcohols having methanol, ethanol, propanol, butanol, isopropanol, isobutanol, pentanol, hexanol, heptanol, octanol and combinations thereof, vegetable oil such as corn oil, mineral oil, coal, coal gas, asphalt vapor, oxidizable vapors from chemical processes, wood, paper and combinations thereof.

15. The method of claim 1, wherein oxidizing the fuel comprises oxidizing within a combustion chamber of a reciprocating engine selected from the group consisting of a gasoline fuel engine and a diesel fuel engine.

16. The method of claim 1, wherein oxidizing the fuel comprises oxidizing the fuel within a combustion chamber of a reciprocating engine, wherein the fuel is selected from the group consisting of number 2 fuel oil, fuel oil refined from crude oil, diesel fuel, gasoline, compressed or liquified natural gas, gasohol, any hydrocarbon having one or more carbon atoms such as methane, ethane, propane, butane, isobutane, toluene, xylene, octane, benzene, mixtures of alcohols having methanol, ethanol, propanol, butanol, isopropanol, isobutanol, pentanol, hexanol, heptanol, octanol and combinations thereof, vegetable oil such as corn oil, mineral oil, coal, coal gas, asphalt vapor, oxidizable vapors from chemical processes, wood, paper and combinations thereof.

17. The method of claim 1, wherein oxidizing the fuel comprises oxidizing within a flame zone of an appratus selected from the group consisting of a furnace, a boiler and an incinerator.

18. The method of claim 1, wherein oxidizing the fuel further comprises oxidizing within an apparatus selected from the group consisting of an incinerator, a vent gas burner, a furnace, a steam turbine and combinations thereof.

19. The method of claim 1, wherein providing the catalyst mixture further comprises providing the catalyst mixture having a pH of less than about 4.0.

20. The method of claim 19, wherein providing the catalyst mixture further comprises providing the catalyst mixture having a pH of between about 1.4 and about 3.0.

21. The method of claim 20, wherein providing the catalyst mixture further comprises providing the catalyst mixture having a pH of between about 1.6 and about 2.2.

22. The method of claim 1, wherein the catalyst mixture comprises a concentration of Pt, as $H_2PtCl_6.6H_2O$ at least about 0.28 mg/ml, a concentration of Rh, as $RhCl_3$ at least about 0.07 mg/ml, a concentration of Re, as perrhenic acid at least about 0.1 mg/ml, and a concentration of Al, as $AlCl_3$ at least about 0.07 mg/ml.

23. The method of claim 1, wherein the catalyst mixture comprises a concentration of Pt, as $H_2PtCl_6.6H_2O$ at least about 0.28 mg/ml, a concentration of Rh, as $RhCl_3$ at least about 0.07 mg/ml, a concentration of Re, as perrhenic acid at least about 0.1 mg/ml, and a concentration of Mg as $MgCl_2$ at least about 0.07 mg/ml.

24. The method of claim 1, wherein the catalyst mixture further comprises a surfactant.

25. The method of claim 2, wherein the liquid further comprises a surfactant.

26. The method of claim 1, wherein mixing a portion of the catalyst with the combustion air comprises transporting the catalyst particles to a combustion air intake to the flame zone and mixing the catalyst with the combustion air within the air intake.

27. The method of claim 1, wherein a ratio of Pt to Rh in the mixture is between about 15 to 1 and about 4 to 1, a ratio of Pt to Re in the mixture is between about 15 to 1 and about 2 to 1, and a ratio of Pt to Al in the mixture is between about 15 to 1 and about 2 to 1.

28. The method of claim 24, wherein the ratio of Pt to Rh in the mixture is about 8.6 to 1, the ratio of Pt to Re in the mixture is about 6 to 1, and the ratio of Pt to Al in the mixture is about 8.6 to 1.

29. A catalyst mixture for use in the generation of fluidized catalyst particles for fuel oxidation, the catalyst mixture comprising:

at least one compound having at least one element selected from the group consisting of group III, group IIA and Lanthanide group; and

at least one compound having at least one element selected from the group consisting of group IA, group IVA, group VI, group VII, group VIII, group IB, group IIB and combinations thereof.

30. The catalyst mixture of claim 29, wherein the catalyst mixture comprises a concentration of Pt, as $H_2PtCl_6.6H_2O$ at least about 0.28 mg/ml, a concentration of Rh, as $RhCl_3$ at least about 0.07 mg/ml, a concentration of Re, as perrhenic acid at least about 0.1 mg/ml, and a concentration of Al, as $AlCl_3$ at least about 0.07 mg/ml.

31. The catalyst mixture of claim 29, wherein the catalyst mixture comprises a concentration of Pt, as $H_2PtCl_6.6H_2O$ at least about 0.28 mg/ml, a concentration of Rh, as $RhCl_3$ at least about 0.07 mg/ml, a concentration of Re, as perrhenic acid at least about 0.1 mg/ml, and a concentration of Mg as $MgCl_2$ at least about 0.07 mg/ml.

32. The catalyst mixture of claim 29, wherein the catalyst mixture further comprises aqueous acid, wherein the catalyst mixture in aqueous acid has a pH of less than about 4.0.

33. The catalyst mixture of claim 32, wherein the aqueous acid is aqueous hydrochloric acid.

34. The catalyst mixture of claim 29, wherein the catalyst mixture in aqueous acid has a pH of between about 1.4 and about 3.0.

35. The catalyst mixture of claim 29, wherein the catalyst mixture in aqueous acid has a pH of between about 1.6 and about 2.2.

36. The catalyst mixture of claim 29, further comprising a liquid comprising substantially equal parts of ethylene glycol and water.

37. The catalyst mixture of claim 35, further comprising one or more of LiCl, NaCl, and HCl.

38. The catalyst mixture of claim 29, wherein the catalyst mixture further comprises a surfactant selected from the group consisting of ethylene glycol, propylene glycol, methanol, ethanol, propanol, butanol, pentanol, hexanol, isopropy alcohol, isobutyl alcohol, silicone oil, and combinations thereof.

39. The catalyst mixture of claim 29, wherein a ratio of Pt to Rh in the mixture is between about 15 to 1 and about 4 to 1, a ratio of Pt to Re in the mixture is between about 15 to 1 and about 2 to 1, and a ratio of Pt to Al in the mixture is between about 15 to 1 and about 2 to 1.

40. The catalyst mixture of claim 39, wherein the ratio of Pt to Rh in the mixture is about 8.6 to 1, the ratio of Pt to Re in the mixture is about 6 to 1, and the ratio of Pt to Al in the mixture is about 8.6 to 1.

41. A fuel oxidation system comprising:

a flame zone for oxidizing fuel;

a catalyst chamber having a catalyst mixture therein, the catalyst mixture comprising:

at least one compound having at least one element selected from the group consisting of group III and group IIA; and

at least one compound having at least one element selected from the group consisting of group IA, group IVA, group VI, group VII, group VIII, group IB, group II and combinations thereof; and

a catalyst transport configured to transport catalyst particles from the catalyst chamber to the flame zone.

42. The system of claim 41, wherein the flame zone is that of an open flame.

43. The system of claim 41, wherein the flame zone is that of an enclosed flame.

44. The system of claim 41, wherein the system is configured to oxidize a fuel selected from the group consisting of gasoline and diesel fuel.

45. The system of claim 41, wherein the system is configured to oxidize a fuel selected from the group consisting of number 2 fuel oil, fuel oil refined from crude oil, diesel fuel, gasoline, compressed or liquified natural gas, gasohol, any hydrocarbon having one or more carbon atoms such as methane, ethane, propane, butane, isobutane, toluene, xylene, octane, benzene, mixtures of alcohols having methanol, ethanol, propanol, butanol, isopropanol, isobutanol, pentanol, hexanol, heptanol, octanol and combinations thereof, vegetable oil such as corn oil, mineral oil, coal, coal gas, asphalt vapor, oxidizable vapors from chemical processes, wood, paper and combinations thereof.

46. The system of claim 41, wherein the flame zone is a combustion chamber of a reciprocating engine selected from the group consisting of a gasoline fuel engine and a diesel fuel engine.

47. The system of claim 41, wherein the flame zone is a combustion chamber of a reciprocating engine configured to oxidize a fuel is selected from the group

consisting of number 2 fuel oil, fuel oil refined from crude oil, diesel fuel, gasoline, compressed or liquified natural gas, gasohol, any hydrocarbon having one or more carbon atoms such as methane, ethane, propane, butane, isobutane, toluene, xylene, octane, benzene, mixtures of alcohols having methanol, ethanol, propanol, butanol, isopropanol, isobutanol, pentanol, hexanol, heptanol, octanol and combinations thereof, vegetable oil such as corn oil, mineral oil, coal, coal gas, asphalt vapor, oxidizable vapors from chemical processes, wood, paper and combinations thereof.

48. The system of claim 41, wherein oxidizing the fuel comprises oxidizing within a flame zone of an appratus selected from the group consisting of a furnace, a boiler and an incinerator.

50. A method of oxidizing fuel, the method comprising:

sparging a gas through a catalyst mixture comprising at least one Platinum compound and at least one compound containing at least one of Aluminum and Magnesium;

mixing catalyst mixture particles with combustion air prior to adding fuel; and

oxidizing fuel in the presence of the catalyst-containing combustion air.

51. The method of claim 50, wherein the sparging gas is selected from the group consisting of helium, argon, nitrogen, air and combinations thereof.

52. The method of claim 50, further comprising ionizing the sparging gas prior to sparging it through the catalyst mixture.

53. The method of claim 50, further comprising transporting the particles to a flame zone under negative pressure.

54. The method of claim 50, further comprising establishing a catalyst mixture having a pH of less than about 4.0 prior to sparging the gas through the catalyst mixture.

55. The method of claim 50, further comprising establishing a catalyst mixture having a pH of between about 1.4 and about 3.0 prior to sparging the gas through the catalyst mixture.

56. A catalyst mixture for oxidation of a fuel, the catalyst mixture comprising:

about 0.2.4 mg/ml of $H_2PtCl_6.6H_2O$;

about 0.28 mg/ml of $RhCl_3$;

about 0.4 mg/ml of $HReO_4$; and

between about 0.28 mg/ml and about 0.56 mg/ml of at least one of $AlCl_3$ and $MgCl_2$.

57. The catalyst mixture of claim 56, wherein a ratio of Pt to Rh in the mixture is between about 15 to 1 and about 4 to 1, a ratio of Pt to Re in the mixture is between about 15 to 1 and about 2 to 1, and a ratio of Pt to Al or Mg in the mixture is between about 15 to 1 and about 2 to 1.

58. The catalyst mixture of claim 57, wherein the ratio of Pt to Rh in the mixture is about 8.6 to 1, the ratio of Pt to Re in the mixture is about 6 to 1, and the ratio of Pt to Al or Mg in the mixture is about 8.6 to 1.

59. The catalyst mixture of claim 56, wherein the total volume of the catalyst mixture is about 650 ml.

53. The catalyst mixture of claim 51, the liquid further comprising one or more of HCl, NaCl, and LiCl.

54. The catalyst mixture of claim 53, wherein the liquid comprises approximately 5400 ppm of LiCl by weight.

55. The catalyst mixture of claim 49, further comprising hydrochloric acid.

56. The catalyst mixture of claim 49, wherein the catalyst mixture has a pH of less than about 4.0.

57. The catalyst mixture of claim 49, wherein the catalyst mixture has a pH of between about 1.2 and about 4.0.

58. The catalyst mixture of claim 49, wherein the catalyst mixture has a pH of between about 1.4 and about 3.0.

59. The catalyst mixture of claim 49, wherein the catalyst mixture has a pH of between about 1.6 and about 2.2.

60. The catalyst mixture of claim 49, wherein the catalyst mixture further comprises a surfactant selected from the group consisting of ethylene glycol, propylene glycol, methanol, ethanol, propanol, butanol, pentanol, hexanol, isopropy alcohol, isobutyl alcohol, silicone oil, and combinations thereof.